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UNITED STATES
NAVAL POSTGRADUATE SCHOOL

THESIS

A DISCRIMINATIVE STUDY OF NAVY WORK SIMPLIFICATION AND SYSTEMS ANALYSIS PROGRAMS

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A DISCRIMINATIVE STUDY OF

NAVY WORK SIMPLIFICATION AND SYSTEMS ANALYSIS PROGRAMS

In Partial Fulfillment

of the Requirements of the Management School

United States Naval Postgraduate School

Monterey, California

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May 1960

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CHAPTER I

INTRODUCTION

An evaluation of the working efficiency of Naval organizations in comparison with the efficiency of non-military organizations illustrates some interesting points of likeness and difference. One of the most prominent features of the commercial world is the emphasis on means of improving competitive effectiveness. In industry, better means for accomplishing objectives are continuously sought. The dynamic interest of profit-motivated organizations in improved efficiency appears to be matched, by the military, with an attitude of moderate but increasing interest.

One of the means of securing improvement involves analysis of operations with a view toward eliminating, combining, rearranging or simplifying them. This process is usually called work simplification. More advanced techniques for improving efficiency are known as operational, or systems, analysis. These practices are widely followed by commercial organizations, and to a certain extent by the Naval Shore Establishment. A modest work simplification program has only recently been adopted as a tool for use by operating commanders, and systems analysis is as yet an art not practiced by the fleet.

One of the reasons that efficiency seems to be de-emphasized by the military is that decisions regarding personnel allowances and manning levels are a resultant of the manpower requirements of the Operating Forces (which are in turn based on estimates and experience-judgments, the "maintenance and operation factor") on the one hand and manpower availability figures on the other. These decisions are made in a context which recognizes a traditional approach to peacetime manning levels, an approach which recognizes that fighting ability is reduced in peacetime due to manpower limitations, but that mobilization in event of war will bring the fleet up to its war compliment.

The concept of the "short war" and the continuation of "semi-peace" sets the background for a comparison of military and commercial attitudes on efficiency.

Following the outbreak of a major war, neither civil nor military organizations can logically expect to make substantial additions to their organizational structures. A doctrine of mobilization build-up to a war footing is ruled obsolete by the short war concept. Following the outbreak of a hot war, each organization must operate as best it can for as long as it can, without reorganization, reinforcement or resupply. "General mobilization" will not be possible if war-warning is on the order of minutes. Further, after the first few hours, the mobilization base of the economy, if not actually destroyed, will be so disrupted as to prevent systematic support of the operating forces.

Under the philosophy of the short war, war readiness and peace readiness cannot be two different things. As this philosophy applies to manpower, peacetime manning levels <u>are</u> wartime manning levels.

The distribution of manpower in Navy tactical organizations is also a factor which limits the number and effectiveness of units available for assignment to cold war or semi-peace duties. Assuming that a type-commander has a certain number of men available for assignment to his units, and the units require a specific number of men, the number of units available to the type-commander is limited by (among other things) his ability to man them. For this reason, it is a matter of military necessity that we assure ourselves:

(a) that personnel allowances are realistic in assigning the correct numbers and qualifications of personnel to permit the unit to fulfill its objectives, and

(b) that this assignment of manpower is based on determination of the proper number of men to do the necessary work in the correct manner.

The United States Navy gives considerable attention to Item (a), the problem of allowances. Unit allowances are under continuous scrutiny and are frequently revised, particularly in regard to provisions for changes in the rating structure. But in regard to Item (b), one observes an interesting anomaly. In comparison with civil organizations, the operating forces of the Navy appear to give a minimum of organized attention to developing the best methods of doing the necessary work. Little urgency has been attached to the proposal that we improve our traditional work methods. "Allowances less x per cent" is the scale with which we have manned our organizations for years. As far as can be determined, no systematic study of the methods by which our organizations can best fulfill their commitments, with a minimum usage of manpower, has ever been made.

One result of this failure to analyze our objectives and working techniques has been a lethargy in adopting modern working methods. Another is the continuous "layering effect," as administrative requirements, laws, policies, directives and orders are translated and implemented, and implant themselves into our working habits. In comparison with commercial organizations operating similar work systems, there is reason to question whether our input of manpower and effort gives us our money's worth of product.

The suspicion that our traditional work methods are not particularly efficient is shared by an authoritative and highly critical segment of American society. Charges of "Pentagon Waste," no matter how debatable, carry considerable force when presented in an outspoken manner by competent observers of the competitive scene. As the shortage of peacetime appropriations continues, Congress or other financially-interested bodies may be expected to become increasingly hostile to any habits that may exist on the part of the military of accepting less-than-logical processes in the use of its material and manpower.

The purpose of this paper is:

1. To examine the possibilities of an organized approach to work simplification by the operating forces, and to consider some of the problems likely to be encountered in introducing systematic work simplification.
2. To suggest that while work simplification as it is now practiced by industry and the Naval shore establishment can be very useful as a tool toward increasing working efficiency, there is a second approach which offers even more promise. This is the "systems" concept.

CHAPTER II

BACKGROUND OF WORK SIMPLIFICATION

In 1932 Allan H. Mogenson wrote a book called Common Sense Applied to Motion and Time Study in which he proposed a new approach toward economy and efficiency in industry. His new plan was called "work simplification."[1] Work simplification emphasized the ability of every worker and supervisor to make valid observation of operations and to devise ways of improving those operations. This method required, mainly, that the observer be capable of basic systematic analysis of the operations which he observed. The advantages of work simplification were obvious. It offered an ideal way for the rank-and-file to participate in the improvement of operations. Not only did this make good economic sense, but it offered psychological satisfaction as well. It capitalized on the traditional American urge to find a better way to do things. And while a reasonable amount of training in the nature of work analysis was to be preferred, Mogenson's method had the advantage of requiring considerably less investment in training, and analysis effort than did time and motion study or similar industrial engineering methods.

Speaking in September, 1959, Mr. Mogenson defined work simplification as "the organized application of common sense to the process of doing work." Inferior quality, high cost production, slow development and poor production rates he ascribed to the lack of work simplification methods. Mr. Mogenson advocated the following program:[2]

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[1] By Professor Erwin H. Schell of Massachusetts Institute of Technology.

[2] "Report of the Eighth Annual Meeting of the Standards Engineering Society," The Magazine of Standards, XX (November, 1959), p. 327. This article describes a speech by Mr. Mogenson at the eighth annual meeting of the Standards Engineering Society.

1. Develop and teach a philosophy of work simplification by study, instruction and by inviting all employees to participate in the program.
2. Investigate all operations to secure a factual basis for analysis.
3. Analyze operations, challenging each detail.
4. Select or develop a preferred method.
5. Institute the preferred method, making certain that it is applied correctly.

On the whole, the idea of work simplification has been well accepted by the industrial and commercial world, although its proponents would say that the response has been less thorough than the advantages of the system deserve. As a measure of its success, a decade after the formulation of the idea—by the middle of the Second World War—supervisors trained in the nation-wide Training Within Industry Program were given a brief course in work simplification techniques.[3] Following the war, acceptance of work simplification continued to grow and it is today a normal feature of good management in large organizations. Formal programs for the development, recognition and adoption of improved work methods are commonplace. Business literature continuously publicizes improved work methods.[4] In a typical industrial organization which practices work simplification today, a supervisor is likely to be able to construct a flow chart, has an awareness of motion economy principles, is well informed on the high cost of

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[3] L. P. Alford and H. Russell Beatty, Principles of Industrial Management (New York: The Ronald Press, 1951), p. 492. For additional information on Training Within Industry Program see also William H. Newman, Administrative Action (New York: Prentice-Hall, Inc., 1955), p. 86; Dale Yoder, Personnel Management and Industrial Relations (New York: Prentice-Hall, Inc., 1951), p. 255; and Franklin E. Folts, Introduction to Industrial Management (New York: McGraw-Hill Book Company, Inc., 1954), p. 108.

[4] See various recent issues of Factory Management Methods, Supervisory Management, Systems and Procedures, Office Management, Management Review.

not making improvements and has an attitude which encourages work simplification proposals.[5]

Over the years there have grown up three basic variations in the meaning of the term "work simplification." The interpretations change depending on the scalar level of the organization which is involved in the work simplification program, as follows:

1. Worker-oriented work simplification programs.

Mogenson's "organized application of common sense" is an often-used phrase that seems to be directed toward less experienced participants, toward workers who may have a minor degree of training in motion economy, layout, or the like, and toward supervisors who perhaps have had some additional training and who encourage a "teamwork" approach to "working smarter, not harder." A typical worker-oriented work simplification program involves a system for bringing forth valuable suggestions and a team-effort atmosphere. "The predominate emphasis /in present day/ work simplification programs lies in the direction of group participation," says one observer.[6] "There seems to be little doubt that 'getting people into the act' does more to produce positive results than does any other technique. . . Psychologically, people are not likely to impede positive results of an idea which they have had a part in developing. But even more important, they will help sell an active interest on the part of their fellow workers. . . /Work simplification/is the organized application of common sense to the solution of business problems. Knowledge shared by many employees is brought to focus on a single problem or a group of related problems, to the end that all necessary work is accomplished in a highly

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[5] L. L. Livegood, "Work Simplification at DuPont," Supervisory Management, IV (July, 1959), pp. 2, et seqq.

[6] Milton Holzhaeuser, "The Work Simplification Concept," Workshop for Management, The Report of the Eighth Annual Meeting of the Systems and Procedures Association (hereinafter referred to as Workshop for Management) (Greenwich, Connecticut: The Management Publishing Company, 1956), p. 213.

efficient manner." Another authority points out that "work simplification is like a course in first aid. It teaches the average person to know how to handle minor ills and what to do until the doctor comes. It doesn't enable the layman to perform major surgery or diagnose baffling illnesses."[7]

2. Engineer-centered concept of work simplification.

For an industrial engineer, work simplification is a term broadly describing the basic purpose of his profession. The field encompasses time and motion study, work process analysis, work measurement and the like. Methods and time study engineers, according to Alford and Beatty, are the real practitioners of work simplification.[8] Under the "engineer-centered concept," the participation of the supervisor and worker, while perhaps helpful, is an item of miscellany. Although a "really smart 'staff expert' will secure a high order of group participation as a part of his 'staff experting'. . . the biggest single advantage in the staff expert approach lies in the facility to accomplish savings rather promptly, and in the saving of line personnel time which otherwise might be diverted."[9]

3. Supervisor-oriented work simplification program.

An emerging view of work simplification combines the other two systems, but emphasizes the role of the lower line authorities. Under this system, each supervisor has a considerable degree of awareness of modern work simplification methods. He can and does use the simpler techniques of industrial engineers, such as flow process analysis, work count, work distribution, space layout,

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[7]David Gindoff, "Getting the Most out of Manual Methods and Devices," Workshop for Management (Greenwich, Connecticut: The Management Publishing Company, 1956), p. 170.

[8]Alford and Beatty, op. cit., pp. 470-492; Ralph M. Barnes, Motion and Time Study (New York: John Wiley and Sons, 1958), p. 536.

[9]Milton Holzhaeuser, op. cit., p. 214.

work sampling and motion economy. He probably does not use more advanced techniques, such as time study. He cooperates with a "work simplification coordinator" who may be an industrial engineer assigned to the encouragement of the work simplification program. He trains his subordinates in the more basic concepts and encourages them to use initiative in developing improved methods.

The supervisor-oriented program is most suitable to situations wherein:

(a) There is a shortage of industrial engineers,

(b) Either the work force is sufficiently stable as to be able to absorb considerable training in such matters, or sufficiently unstable as to prevent significant training, and

(c) The supervisory ranks are filled with highly competent professional supervisors.

The supervisor-oriented work simplification program is especially adaptable to organizations possessing the characteristics of Naval units. The Navy-sponsored program for training senior petty officers and junior officers in work simplification is supervisor-oriented.

The Navy has recognized work simplification as a valuable means of improving efficiency. Work simplification programs are in effect in substantially all Bureau-controlled activities. Navy instituted work simplification programs are entirely comparable to industrial work simplification programs, being: (a) administered by industrial engineers, (b) backed by positive supervisory activity, and (c) worker participation oriented. These Bureau-sponsored programs have unquestionably contributed to increased efficiency and economy in Navy projects involving industrial-type work, just as many industrial work simplification programs have led to remarkable increases of output and reduction of costs.

Unfortunately, the success of the shore establishment in putting work simplification to work has not been accompanied by equal success on the part of the operating forces. Surprisingly,

no systematic work simplification program has ever been adopted by the operating forces. Improved procedures of various types are undoubtedly established in the operating forces through the desire of individuals or of individual units to improve their efficiency. Nevertheless, failure of the fleet to adopt a program comparable to those used by the Bureaus or similar to those widely used in industry is a puzzling situation. Whereas the fleet makes every effort to adapt to the changing work patterns brought about by the introduction of the most advanced technical equipment, the operating forces are well behind the shore establishment in the field of improving work methods.[10] Through its neglect of this matter, one may conclude that the fleet is expending a good deal of effort and material that probably would not be expended by a civil enterprise committed to meeting similar objectives in a competitive atmosphere.

Fortunately, the first stages of the solution of this problem seem to be developing. The Chief of Naval Operations has established two Fleet Work Study groups with the mission of helping obtain the optimum use of the human and material resources available to the operating forces.[11] Valuable assistance is at hand for this project, in the form of a group of petty officers (the PNC and PN1 rates) with some training in this area.

What are some of the difficulties that are likely to emerge in the establishment of a large scale approach to work simplification? What are the best methods of avoiding some of these predictable problems? What can be learned from the

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[10]Since the average petty officer and junior officer has not yet received the equivalent of the ten-hour course in work simplification given on a nation-wide scale to civilian supervisors at the height of the war, it may be said that the operating forces are at least fifteen years behind industry in this important field.

[11]OPNAV INSTRUCTION 5250.1, Fleet Work Study Program, 12 February, 1960.

experience of the Bureaus and industry which can make Fleet Work Study a successful reality? These and similar questions are examined in subsequent chapters.

CHAPTER III

THE STATUS OF MODERN INDUSTRIAL MANAGEMENT METHODS IN THE NAVY

To understand more clearly the position of the Navy in regard to formal application of modern management methods in general and work simplification in particular, it is well to review the status and background of these aspects of management in industry and to observe the degree to which these methods have been adopted by the Navy.

Beginning eighty years ago, the era of factory production as it was originally developed by the industrial revolution came to an end. The older "factory system" was swept away by the rise of modern industrial methods. These methods were characterized by assembly lines and mass production, by standardization of products and practices, and by an emphasis on technology. The new methods were made possible by the introduction of new sources of power—electricity and internal combustion engines—by the invention of hundreds of new devices, and by a revolution in communication and transportation. Modern methods brought a complete change in the whole field of industrial production.[1]

Accompanying these remarkable changes in production processes came an awareness, on the part of the managers responsible for this production, that customary management practices and attitudes were not suitable under the new conditions.[2] The problem was to maximize the effectiveness of the new machines and of the organizations which operated them. From the thinking of the engineers and organizational executives who were called on to face and solve the

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[1] Lawrence L. Bethel, Franklin S. Atwater, George H. E. Smith and Harvey A. Stackman, Jr., Industrial Organization and Management (New York: McGraw-Hill Book Company, Inc., 1950), p. 12.

[2] George Filipetti, Industrial Management in Transition (Homewood, Illinois: Richard D. Irwin, Inc., 1953), pp. 2-56.

technical and organizational problems of this era came a philosophy, a body of principles and a system of practices that have had a profound effect upon the further expansion and development of the institution of industry—and of many other cultural institutions of the modern world.[3] This philosophy was called "Scientific Management," and it can best be described as "the application of an analytical approach to the problems of management."[4]

The leader of the scientific management movement was Frederick W. Taylor, who believed that the principal objective of management should be "to secure maximum prosperity for the employer, coupled with maximum prosperity for each employee." Taylor maintained that these objectives could be met by the acceptance of a new philosophy of industrial management, that of scientific method.[5] His greatest contribution was the advocation of a scientific approach to the organization of work, a field in which rule-of-thumb had formerly been dominant. Secondarily, his investigation to obtain scientific data as to the best way for standardizing a task with the least expenditure of effort formed the foundation for what is now known as time study.[6] Further, his efforts pioneered in incentive pay plans, scientific selection of employees, functional organization, materials and tool standardization, modern production control and numerous other techniques of value in management today.

Although Taylor realized and stated that there was more to the management of an industrial enterprise than management in the workshop, his stress on efficiency at the shop level and the

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[3] L. P. Alford and H. Russell Beatty, Principles of Industrial Management (New York: The Ronald Press, 1951), pp. 26-27.

[4] Ibid., p. 33.

[5] Ibid., pp. 27-28.

[6] Ralph M. Barnes, Motion and Time Study (New York: John Wiley and Sons, 1938), p. 13.

economies to be gained through study of direct work caused attention to be drawn away from the more general aspects of management.[7]

Following closely on the work of Taylor came the efforts of several other students of scientific management. Notable among these were Frank B. Gilbreth, who developed motion study; his wife, Lilian Gilbreth, who contributed both to motion study and the psychology of management; Harrison Emerson, who observed that efficiency serves the best interests of both the employer and employee; and Henry L. Gantt, who emphasized that management is the leading of humans rather than the command of machinery. It was these and a few other leaders who in their writings near the turn of the century first described the nature of the science of management.[8]

The scientific management movement had many obvious advantages and was widely accepted by industrial managers as offering a source of greatly improved efficiency at little cost. Many successful applications were made of Taylor's "shop management" techniques. In the rush to capitalize on the new development, however, were many managers who were anxious to make a good showing but who were equipped only with a pseudo-scientific knowledge. These "efficiency experts" often introduced improved methods, but gave negligible attention to the associated problems of human relations. Not only was it characteristic of practitioners of this nature to ignore and override normal worker reaction to change, but the conditions of the time did not permit a considerate interchange between affected workers and their managers. Once new methods were established, many factory managers of that time unscrupulously cut rates when an

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[7]Harold Koontz and Cyril O'Donnell, Principles of Management (New York: Mc-Graw Hill Book Company, Inc., 1959), p. 22.

[8]For short descriptions of the lives and contributions of the leaders up to World War I see H. B. Drury, Scientific Management, A History and Criticism (New York: Columbia University, 1918), p. 98 et seqq.

employee made what the manager felt was too much money.[9] This was the "speed-up" in its most hypocritical form--under the guise of "science." Labor soon grew to fear and hate "scientific management."[10] The objections of labor to such tactics were so acrimonious as to be partially effective to this day, despite the efforts of conscientious managers to overcome the objections and to remove the reasons for them.[11]

By about 1910 scientific management was under close and hostile scrutiny by large elements of the society. Although the possible increases in efficiency were widely recognized,[12] the numerous and well-founded criticisms of the system eventually resulted, among other things, in the prohibition of time study and premium pay in work for which federal funds were appropriated.[13] For many years, labor organizations were outspoken in their objections to the various features of scientific management.[14]

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[9]Drury, op. cit., p. 35.

[10]Carroll R. Daugherty, Labor Problems in American Industry (Boston: Houghton Mifflin Company, 1933), p. 94.

[11]Dale Yoder, Personnel Management and Industrial Relations (New York: Prentice-Hall, Inc., 1951), p. 698.

[12]One estimate by Harrington Emerson which received wide publicity was that "the railroads of the nation could save a million dollars a day by recognizing the techniques of modern scientific management." See Yoder, op. cit., p. 50. Writing in 1911 Harrington Emerson expressed his view: "It is unfortunate that the employer shies at the suggestion of a 10 per cent advance and pays scant if any attention to a 50 per cent inefficiency, two-thirds of which may be his own fault." Harrington Emerson, The Twelve Principles of Efficiency (New York: The Engineering Magazine Company, 1917), p. 199.

[13]This limitation remained in effect until 1947, when it was modified. It was finally lifted completely in 1949.

[14]Daugherty, op. cit., p. 698.

The First World War focused attention on worker productivity as had no previous event in history. Many new and valuable contributions in the field of industrial manpower utilization came into use. Personnel classification received its first introduction on a wide-spread basis. Intelligence and skill tests and job classification came into use. The governments of the industrial nations began to sponsor agencies interested in the productiveness of manpower.[15] This great emphasis on the workforce as an element of production resulted in the formulation of the body of management doctrine that came to be known as Personnel Management.[16]

The decades of the 1920s and 1930s were marked by continued attention not only to scientific management techniques and increasingly complicated processes and products, but also by the increasing importance of the field of personnel management. The rising power of organized labor made both management and labor more and more aware of the importance of manpower as an element of production.[17] Unfortunately, this period was marked by economic crises. The reactions of both management and labor to these crises, and the increasing effect of government regulation, were more characteristic of the between-wars era than was gradual maximization of organizational effectiveness through the development of improved management.[18] Nevertheless, the "second industrial revolution" proceeded, and despite the problems of the time and despite many instances to the contrary, production efficiency and personnel utilization reached new highs.

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[15] Yoder, op. cit., p. 51.

[16] Daugherty, op. cit., p. 715.

[17] Filipetti, op. cit., p. 139 et seqq.

[18] "Such management /scientific management/ does not work except with the heartiest consent and help of the men under it." Filipetti, op. cit., p. 135.

The most significant contribution in the field of management following the early days of the scientific management movement was the work of Henri Fayol, a French industrialist. His primary attention was directed at the administration of organizations. He emphasized, as had Taylor, that effective management is to be found not in the uncovering of some divinely endowed individual, but in the correct application of basic principles.[19] Fayol regarded the elements of management as its functions. These he perceived to be: planning, organizing, commanding, coordinating and controlling. His observations, which were first introduced into the thinking of English-speaking managers in the late 1920s, form the basis for most current thought on this subject, and to that extent he is the real father of modern management theory.[20]

There is little reason to believe that scientific management had nearly as much impact on the thinking of military leaders in this country as it had on the thinking of their counterparts in business. The military literature of the period offers little evidence to show that much attention was given to an analytic approach to the problems of managing the military forces. On the other hand, the military had a long history of interest in matters of organization and leadership, affairs which have their counterpart in the business world. The decades of peace permitted the development of a body of officers who received advanced education at the Army and Navy War Colleges and other Postgraduate Institutions. The officer educational systems of the Armed Forces were far in advance of their time and only now are being equaled by civil executive development programs. Several advanced techniques were adopted by the Army and Navy including testing programs for classifying or rejecting recruits and very large punched card installations for

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[19] Filipetti, op. cit., p. 155.

[20] Koontz and O'Donnell, op. cit., pp. 23-27. This is not to say that current thinking does not include an element which challenges some of the basic doctrine of modern management theory.

the personnel accounting system of the Bureau of Navigation. On the whole, however, it would be difficult to make a case that the military was much affected by contemporary management thought.

Since the First World War the development of managerial theory and practice has received the attention of such a large number of individuals that it is possible to list their contributions only in the broadest terms. The problems of management have been given attention by numerous businessmen, by teachers, by agencies of the government and by organizations devoted to the improvement of management. The studies of psychology and sociology have helped significantly in the development of modern managerial philosophy. Today a dynamic literature deals with the problems and practices of the management profession.

A few years after the introduction of the concept of scientific management, the practices of Industrial Management were sufficiently well developed and its disciplines sufficiently well formulated that programs of study leading to formal qualification in Industrial Engineering and Business Management were offered by most major universities.[21] While the state of affairs in business and industry during the 1930s was far from tranquil, there is no question but that the management group in American society was growing in numbers and in awareness of its functions.[22] With the coming of World War II good management practices did much to heighten war production. At a time when one fifth of the normal labor force were occupied with military duties, industry converted to a war-time basis, and by recruiting and training millions of new workers, accelerated production. Spectacular results were achieved through widespread introduction of modern methods in several fields, notably: the wide use of job analysis and descriptions, formal

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[21] Alford and Beatty, op. cit., p. 34.

[22] Filipetti, op. cit., p. 298.

description of organizational relationships and man specifications to locate manpower needs and wastes, and the development of several extremely successful training programs. These methods had direct peacetime application and undoubtedly influenced much of post-war management practice.[23]

The formal introduction of industrial engineering to the Navy took place during World War II. At that time the Navy Management Engineering Office was established and staffed with a group of Naval officers recruited from industrial management and consultant firms. This office, through various organizational changes, evolved into the present Navy Management Office (composed of both Industrial Engineers and Management Analysists) which reports directly to the civilian executive level.[24]

Following the end of the war, all Bureaus and large industrial activities of the Navy set up industrial engineering groups. After the lifting of the ban on time study, Navy Industrial Engineering efforts emphasized techniques of measuring work performance. Statistical work measurement, engineered time standards and work sampling are methods in common use. Methods engineering has also received considerable attention. As industrial experience had proved, remarkable savings could be and were achieved through the use of improved work methods and techniques.[25]

The number of industrial engineers in the Navy today is about 350. The number of persons engaged indirectly in the field or in related fields is not known but appears to be substantial. The status of industrial engineering in Naval shore establishments seems to be comparable to that in most of the larger private organizations,

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[23] Yoder, op. cit., pp. 53, 255; Filipetti, op. cit., p. 310.

[24] Naval Management Office, Naval Management Review, IV (December, 1959), p. 4.

[25] Ibid.

and there is no reason to believe that the importance of this field will diminish.

The chief post-war developments in the civil world have involved wider application and refinement of proved techniques. Methods time measurement and work factoring methods, for example, are post-war refinements of earlier techniques. Planning and control of operations have been increasingly emphasized.[26] "An increasing rate of application of industrial management techniques, rather than the mere fact of their application, is probably the most important characteristic of the post-war management field."[27]

Various programs have been adopted by the technical Bureaus to increase the effectiveness of the work being performed. BUDOCKS, for example, is concerned with shore station public works, which includes building maintenance, care of utility systems and upkeep of automotive equipment. Its program follows four main lines:[28]

1. The development of a basic system for controlling work input, planning, estimating, scheduling and the accumulation of statistics for performance evaluation.
2. Engineered performance standards, emphasizing transferability between stations.
3. Work simplification.
4. Engineered shop layouts.

According to the same source,[29] the techniques most used by the Bureau of Aeronautics in its Overhaul and Repair operations

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[26] Filipetti, op. cit., p. 310.

[27] Ibid., p. 311. As will be emphasized hereafter this characteristic is being modified at the present time by an increasing preoccupation on the part of large elements of management with automatic production equipment and electronic information-handling systems. The war-developed mathematical analysis techniques, known as Operations Research or Operations Analysis are now extremely important techniques in the practice of management.

[28] Naval Management Office, op. cit., p. 5.

[29] Ibid., p. 11.

include time study, methods study and engineering, materials handling, plant equipment layout and quality control. The Bureau of Ordnance had a modest work simplification program[30] and was, in fact, a pioneer in statistical sampling. Presumably the combination of these two bureaus into the Bureau of Naval Weapons will not hinder their previous progress toward the adoption of advanced industrial engineering practices.

The Bureau of Ships has an active industrial engineering program in its shipyards, which are in the apparent position of competing with commercial shipyards in a large portion of their work. In the case of BUSHIPS, a dollar comparison with civil enterprise is more valid than is the case of many other Naval functions. Under the pressure of this comparison, BUSHIPS has established a creditable Management Improvement Program.

Toward the end of the Korean War, a Navy Report of Manpower Utilization stated that:

> Formalized programs have . . . grown in numbers and effectiveness. The Bureau of Ships, starting a year ago, is now well along in its Production Planning and Control Program. All Naval shipyards have this program in one or more shops. The Bureau of Aeronautics has instituted a formalized management program in two air stations in the Overhaul and Repair production shops. Due to the significant success of this program, called engineered job performance standards, in the two stations, the Bureau is expanding the program to all the other Naval Air Stations having Overhaul and Repair shops. Methods for simplifying operations have increased both in quantity and quality, including a new training program for supervisors by the Office of Industrial Relations, a work simplification procedure for BuPers field activities, and the spread of the BuSandA Methods Improvement Program to other bureaus and offices.[31]

The sum of these considerations is to point out that the technical bureaus have an active interest in modern industrial

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[30] U. S. Navy Department, The Bureau of Ordnance Manual (Washington, D. C.: Government Printing Office, 1955), p. 510

[31] Assistant Secretary of the Navy for Air, Report on Manpower Utilization United States Navy (Washington, D. C.: Government Printing Office, 1953), p. 3.

engineering practice. Implicit in all of these programs is an emphasis on finding better ways to accomplish the work objective. Not only are these approved methods the subject of study by engineers, but the Navy has an aggressive plan for drawing proposals for improvement from the men on the job. Beneficial suggestions are invited from all workers, and civilians are offered tangible rewards for suggesting improvements. The number of suggestions adopted in 1953 was 23,000, and by 1958 this number had grown to 40,000.

A program for the instruction of workers and supervisors in the basics of work simplification spread to the fleet in 1947. In that year the rating of Personnel Man was established, and a knowledge of work simplification was required of candidates for the rating of PN1 and PNC. The creation by BuPers of special schools[32] to teach the fundamentals of work simplification (in connection with a course emphasizing organization analysis) followed shortly thereafter. These schools also trained junior officers on a voluntary and apparently limited basis. These "Class C" schools have since produced many hundreds of officer and petty officer graduates who have an understanding of work simplification.

In 1953 the Bureau of Naval Personnel published Navpers 18539 Work Simplification for Naval Units, which with its associated instruction documents formed a basis for a do-it-yourself approach to work simplification. The aim of these publications was to assist officers and petty officers in locating problem areas, analyzing these areas and installing improved work methods to insure the efficient use of the Navy's manpower resources. Work Simplification for Naval Units outlined in easily understood terms the basics of: Work distribution, work count, flow process analysis, motion economy and space layout.[33]

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[32] See BuPers Instruction 5202.14 (1956).

[33] The inclusion of these five functions in a single work simplification program actually involves a grasp of a series of

It might be expected that the introduction of work simplification ideas into the fleet followed as a natural result of the encouragement of such ideas by the Bureaus, and the possession of practical knowledge by a certain group of trained personnel. Unfortunately, there is little evidence of simplified procedures finding their way to sea. As nearly as can be determined, no commander of fleet units has undertaken a systematic program on a scale comparable to those programs developed by the Bureaus leading to better utilization of manpower. One observer, writing in January, 1955, commented:

> Many of these proven methods and systems /for accomplishing more with less manpower and money/ are already in use in the Navy at the present time, but there are two systems specifically, work measurement and work simplification, that are not being used throughout the Navy. This is especially true as applied to the utilization of military personnel.[34]

This situation remains in effect today.

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concepts usually thought of as being included in methods study work. The Navy concept of work simplification programs, then, involves considerably more than "the organized application of common sense to the process of doing work." For purposes of this paper, work simplification is defined as including the five basic functions set forth by Work Simplification for Naval Units. It is distinctly a "supervisor-oriented" concept.

[34] Thomas L. Conroy, "Better Utilization of Military Manpower Through the Use of Management Engineering Techniques," (Unpublished Master's Thesis, George Washington University, Washington, D. C., 1955).

CHAPTER IV

PROBLEMS OF WORK SIMPLIFICATION PROGRAMS

A great deal of evidence shows that the introduction of work simplification leads to improved performance by organizations in the accomplishment of their objectives with a minimum of effort and expense.[1] Every consideration based on logical reasoning commends an active program of work simplification in any organization. Yet there are several factors which inhibit efforts to make work simpler and easier. The fact that these resistive forces are largely illogical, that they arise from intuitive objections rather than reasonable ones, or that they are based on false premises does not reduce their potency. These objections cannot be ignored by anyone associated with a work simplification project. They can be reduced or avoided by skillful leadership; but to avoid them they must be understood.

One of the characteristics of any program which changes the operations of an organization is that the success of the new program depends largely on the willingness of the organization to adopt the change. This is not always easily accomplished. Even the best of engineered studies and similar improvements based on intellectual decisions are often resisted for emotional reasons by the workers and supervisors who are expected to adopt them. Work simplification, being a cooperative venture at improving work, is especially vulnerable to patterns of resistance. It has been estimated that, for one reason or another, over half of the proposals for improvement are put forth at least six times before they are finally adopted.[2]

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[1] For brief amplifications of this observation see Bethel, op. cit., p. 414 et seqq., and Leherer, op. cit., p. 251.

[2] Charles F. Austin, "The Loneliest Man in the Military, the Man with a New Idea," Armed Forces Management, V (March, 1959), p. 27.

This suggests the potency of the negative attitudes that can greet even the best-motivated suggestions.

The introduction of large-scale work simplification programs brings forth two categories of problems: problems centered around individuals and problems arising from the nature of organizations. Of these, the problems of individuals are well-defined and thoroughly discussed in current literature on the subject. The second category is largely undefined, and seems to be most pronounced in decentralized organizations. This chapter briefly reviews the problems associated with individuals, mainly in the interest of acknowledging their existence and noting that certain factors tend to counter the resistive tendencies of individuals. The main intent of this chapter is to examine some of the predictable, but generally undefined problems associated with the introduction of work simplification programs into large decentralized organizations.

PROBLEMS CENTERED AROUND INDIVIDUALS

The participation of an individual in a work simplification program is most often compromised by two factors: his resistance to change and his resentment of real or implied criticism. These are understandable reactions, for everybody intuitively seeks security—which changes threaten—and nobody likes the implication that adherence to a work situation which could be improved reflects on the competence of the individuals involved in the old system.

Specific factors which influence individual reactions to new and changed work conditions are the following:[3]

Fear of loss of job or status. Although the fear of job loss is minimized by membership in the armed forces, a closely allied problem, threat of loss of status must be contended with by

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[3]John M. Pfiffner, The Supervision of Personnel (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958), p. 117 et seqq.

any program bringing forth changed procedures. A new program which tends to reduce the influence or apparent importance of an individual will undoubtedly be resisted by that individual. Customary working habits and organizational relationships will be viewed most favorably by a person who has achieved success under the customary conditions.

Desire for security. The uncertainty accompanying the introduction of revised work patterns runs counter to the universal desire for stability and security. Fear of the unknown is a natural and probably unavoidable reaction.

Resistance by supervisors and managers. The desire to preserve a vested interest is probably stronger in supervisors than in workers. There are possibilities that a questioning attitude, encouraged by a work simplification program, might reveal embarrassing short comings. It often occurs that the higher the rank of the individual, the less secure he may be in his position. This may be especially true in the Navy where the decisions of many high ranking officers are made in an atmosphere which does not allow them to forget that their careers are measured at frequent intervals by an uncompromising system.

Implied criticism. The implication of any proposed improvement is a criticism of the existing procedures. It is next to impossible to criticize a method without criticizing the person doing the job, the one responsible for it, or the person who prescribed that method in the first place. People usually resent criticism. It is necessary to recognize this situation and deal with it effectively if we expect improvements to be acceptable.[4]

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[4]Gordon B. Carson (ed.), Production Handbook (New York: The Ronald Press, 1958), p. 14.4.

Individual resistance to change and resentment of criticism can be countered by influencing attitudes and developing a team approach to the solution of work problems. There are some very powerful psychological forces which can be harnessed to partially reduce the negative reactions of individuals to proposals of change.[5]

People like to participate in group activity. Practically everyone likes to be on a team. The very fact of mutual participation does much to alleviate the ill effects of resistance to change and resentment of criticism.

People like to try to improve. Unless they are inhibited by an outside force people are often motivated to improve the situations in which they find themselves.

People have certain other universal desires. Many of these desires can be fulfilled by an active program of work simplification. Chief among these are:

We want to work for people who are understanding, human and appreciate us as individuals.

We want to believe in our own feeling of importance in the scheme of things.

We want confirmation by others of our right to enjoy our self-respect in the form of recognition, esteem and honor.

We want to associate with people who are more important than ourselves.

We want any feeling of increased importance to manifest itself in increased earnings.

We want to share in the tangible results of our own efforts.

We want an opportunity to enhance our own personal status.

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[5] Ibid., 14.5.

PROBLEMS CENTERED AROUND ORGANIZATIONS

There are a number of reactions to change that are more characteristic of organizations than of individuals. Some of these are well-known. Others only become apparent after examination of the reactions of large-scale organizations.

The leveling tendency of informal organization is well-known. Many human organizations tend to resent and isolate those who demonstrate superior competence. Thus, the informal organization frequently adds its opposition to new ideas to the opposition of individuals as a means of preventing spectacular performance.

The introduction of changes requires increased effort and output from organizations. In addition to the direct effort of formulating the proposal and installing the new system, problems of re-appraising indirectly affected areas—such as personnel policies, training programs, equipment requirements and the like—require the attention of portions of the organization which would not be affected had the change not occurred.

The overall requirements of large organizations tend to inhibit sub-units from introducing substantial changes. The effect of tradition, of "doing things because we have always done them," is especially marked in military organizations. One reason for this is that the work of sub-units is to a large extent dependent on decisions of higher authorities. Many of these decisions are not predictable by sub-units. A unit which changes its habits to improve its present performance may find that its new systems do not conform to newly issued "standard" orders from above.

Further, an organization must be prepared to show its literal compliance with the expressed requirements of higher authorities, even though proposed improvements could accomplish with less effort the objectives set up by the higher authority. The approval of proposals by several higher levels may require an inordinate expenditure of effort. The old method may in fact be retained because of the high cost of proposing a new one. These

factors tend to cause sub-units to do little toward changing the status quo.

There is reason to believe that many military organizations have grown up around certain work-centers and that traditional work methods are associated with organizations of a certain pattern. An organization might be motivated to decide that a particular function could be more efficiently discharged by a portion of the organization which had not previously been involved in the particular type of work. In this case, the proposal could not be judged on its merits alone, but would have to be reviewed in the light of traditional responsibility patterns within the organization. Thus certain spaces are set aside in ships for the performance of certain work. The fact that in the course of events the work could most effectively be performed elsewhere brings up not only the question of "where can this work best be performed," but also an unrelated question: "What spaces were provided by the builders of the ship for this work, and in whose dominion are those spaces?" Similarly tactical squadrons find, when they are based ashore, that the telephone system is tailored to fit a "standard" squadron and that a re-organization must take into consideration who will get the telephone calls meant for whom. The personnel allowance provides personnel for specific billets, and the fact that these jobs may require dilution or expansion brings up questions unrelated to the proposed expansion or dilution. The "standard methods" taught by training schools tend to be retained in the fleet long after they have been declared obsolete and abandoned by the school. A squadron assumes a heavy training burden in attempting to change a work method taught by a service school. Because organizations "always" have been organized in a particular manner, there is a tendency for them to retain their old form even when a newer one might be more suitable.

The traditional assignment of responsibilities to Commanding Officers makes many functions "command responsibilities" when these could more effectively be performed centrally. Under this system,

each unit performs many functions at low efficiency, which are also performed at low efficiency by neighboring units. Duties requiring a high degree of skill but which are only occasionally performed offer good illustrations of this point. The functions of unit legal officers are perhaps the best example. A unit cannot discharge its legal responsibilities without being staffed with someone who has a good knowledge of legal procedures. There are many occasions when legal matters do not occupy a full-time legal staff. Yet each command must retain this trained talent.

Another factor which tends to inhibit the growth of work simplification practices in military units is the fact that one aspect of a work simplification program seems to run counter to the mores of the profession. This is the "questioning attitude," which challenges the validity of methods in use. The questioning of the edicts of higher authority requires a level of tactfulness not often found, and one suspects that the mortality rate of good ideas is increased when more than one level of military authority is involved.

Another organizational limitation which interferes with the adoption of revised programs by sub-units is the question of responsibility. Let us assume that a Commander has several dozen units which are following outmoded practices. Some of these units are aware, as is the Commander, that their operations are excessively costly, but most are not. (The upkeep practices of destroyers provide a good illustration of this situation.) Whose responsibility is it that these units adopt the most advanced practices? Article 0704 of United States Navy Regulations requires that a Commanding Officer maintain his command in a state of maximum effectiveness. Each of the destroyer COs will swear that his ship is performing at its best. Does full responsibility lie on the Commanding Officer who may be unaware of the problem? Questions of responsibility have one traditional—and no simple answer.

A final characteristic of organizations which interferes with the operation of work simplification programs is a characteristic

which has appeared in some of the centrally-administered Navy programs. In a typical case, organizations engaged in a work simplification program are directed to report the costs of certain types of simplified work to a central authority. This authority then compares the reports, and evaluates the success of the various activities in conducting their affairs. Needless to say, this can easily lead to incorrect conclusions, for local conditions often influence work situations which are outwardly standardized. Apparently several of the Bureau-instituted programs have become entangled in the problems of standardized procedures—a deceptively complicated area.[6] For this and similar reasons, there is some basis for the belief that centralized control may be too inflexible to allow detailed central administration of work simplification programs.

The sum of these considerations of the problems of adapting work simplification to large organizations suggests that there are some very potent forces within organizations which tend to counter innovations. Unlike the problems centered around individuals, there seem to be few specifics to remedy these weaknesses. Chief among these unsolved problems are:

1. The resistive influence of the informal organization.
2. The increased effort initially required to prepare and institute simplified programs.
3. The vulnerability of sub-units to decisions made higher up, and the burden on sub-units in acquiring approval for other than "standard" techniques.
4. The influence of traditional organizational patterns and work methods which tend to persist despite efforts to modify them.

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[6] Anita P. Loeber, "Work Reduction and Measurement Techniques," quoted in Colver Gordon, (ed.), Ideas For Management, Papers and Case Histories Presented at the Eleventh Annual International Systems Meeting (Forge Village, Massachusetts: The Murray Printing Company, 1959), p. 250.

5. The assignment of certain functions to certain units without regard for economical work distribution.
6. The problem of challenging the status quo in military organizations.
7. The question of logical assignment of responsibilities in large work simplification programs.
8. The inflexibility of centralized control.

CHAPTER V

CHARACTERISTICS OF SUCCESSFUL WORK SIMPLIFICATION PROGRAMS

In 1954, as a prelude to establishing its own work simplification program, Sears, Roebuck and Company conducted a survey of companies known to have experience in work simplification. Out of 207 leading United States companies querried, 129 responded to the Sears survey and of these, 85 with the most active programs were subjected to detailed examination. The companies ranged in size from 250 to 40,000-plus employees, and included such well-known organizations as Minneapolis-Honeywell, Du Pont, Consolidated Edison of Detroit.

The practical dollar value of the programs was very significant. One of the larger organizations attributed savings of over one million dollars per year to its program of work simplification. One-tenth of the companies reported savings ranging from 100,000 to 750,000 dollars per year. Other savings ranged from 2,000 dollars per year upward, with savings of 30-50,000 dollars per year not being uncommon. These figures represent returns of 200 to 1,200 dollars for each dollar invested in the work simplification program. Over a third of the companies estimated savings at a ratio of five dollars returned for each dollar invested, and other estimates ranged from "less than 2 to 1" to "about 20 to 1."[1]

While it must be realized that the study involved only companies known to be biased in favor of the programs, that "savings" are difficult to estimate accurately, and "costs of the program" even more so, and further that one would expect the law of diminishing returns to reduce savings as time passes, it is nevertheless

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[1] This information is from Lehrer, op. cit., p. 251, et seq, which summarizes F. W. Simerson and W. D. Test, Work Simplification Survey (Chicago: Sears, Roebuck and Company, 1954). Additional information is from "Work Simplification—Why It Clicks and Why It Fails," Factory Management and Maintenance, CXII (November, 1954), p. 122.

apparent that significant steps toward the efficiency of the companies can be traced to their interest in work simplification.

An important finding of the study was that many benefits not measurable in dollars also flowed from the work simplification programs. Improved attitudes often accompanied official encouragement of participation in work improvement projects. Personnel development occurred as elements of the organizations gave attention to other than routine matters. Logical examination of procedures often helped develop initiative and a cooperative spirit in improving those procedures. Some of the companies had found their programs so useful for reasons of this nature that they stated that non-monetary benefits far outweighed the direct dollar returns.

The programs followed by these 85 companies often had certain characteristics in common. Most notable among these were:

1. Almost all successful programs were formal programs in continuous operation.
2. The successful programs had sincere support from management at all levels.
3. Some formal training in basic work simplification procedures had been given to most managers and to many additional members of the organizations.
4. Successful programs were conducted under the leadership of either:
    (a) Line management only,
    (b) Line management in conjunction with the organization's industrial engineering departments, and/or
    (c) Line management in conjunction with work simplification coordinators.
5. Wide participation was encouraged, usually by one or more devices similar to the following:
    (a) Permanent or temporary committees to evaluate and encourage proposals.

(b) Suggestion systems, either of the "suggestion box" or "chain-of-command" type.

(c) Work simplification teams assigned to specific departments or specific projects.

(d) Special publicity techniques (newspaper articles, bulletin board displays, meetings, awards, etc.).

6. Projects could be originated either by workers, supervisors or staff groups.

7. Adequate skill could be brought to bear on specific problems. Experienced supervisors, industrial engineers or the work simplification coordinators were committed to assist workers in developing their proposals.

8. The protection of the integrity of the program was a matter or considerable concern. "Successful work simplification projects cannot be regarded as a means of exploitation. They are programs for personal development and expression which eliminate waste of resources" typifies the expressions of the companies on this subject.

9. Most of the programs (two-thirds) offered no tangible rewards for improvements.

Several of the characteristics identified by the Sears study as applying to successful work simplification programs deserve specific attention by persons interested in applying work simplification techniques to Naval units. A brief examination of the subject indicates that the operating forces have all the mechanisms necessary to apply work simplification in an organized program and suggests that the program now in its initial stages can be extremely successful. Favorable characteristics of the Navy program are as follows:[2]

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[2]OPNAV INSTRUCTION 5250.1, February, 1960, which describes the program; "Fleet Work Study Program," Naval Management, (May, 1960), p.23, which elaborates on the instruction, are the sources of information on the yet-to-be-initiated program.

1. The Fleet Work Study Program has high level encouragement, being sponsored by CNO and BUPERS and managed by CNO.
2. Staff advisory talent (20 officers and senior petty officers) is available for assignment to projects.
3. The program makes adequate allowance for voluntary acceptance and installation of improvement by fleet units. It encourages initiative at the unit level and reduces the possibility of conflict between staff and line authorities.

Although the auguries for the Fleet Work Study Program are favorable, two disconcerting factors appear in a comparative view of industrial practices and the Navy program.

The most important of these is that a successful work simplification project requires full and sincere management (i. e., command) support, at all levels. Whether this support will be forthcoming is a critical question. CNO and BUPERS encouragement[3] of similar projects through the last decade, as we have seen, cannot be said to have had significant impact on customary working habits in the fleet. This may partially due to the indeterminable nature of responsibility for success of a program which is based on cooperation rather than command.[4] Further, the Work Simplification Program has been only one of many programs. It has received, historically, considerably less emphasis than, say, the Safe Driving Program, The Material Conservation Program or the numerous fund-raising campaigns. Then, too, a certain amount of training is required before most people—especially key personnel—can understand the nuances of such a program; and this training has not been conducted on a sufficient scale to expect that the persons who would have to carry out such a program were actually competent to do so.

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[3] See for example OPNAV INSTRUCTION 4100.1 of 1951 and BUPERS INSTRUCTION 5202.14 of 1956, both of which stress the need for improved practices, manpower and material conservation, etc.

[4] This problem is examined in detail in the following chapter.

The second cause for concern which should prove easily avoidable since the shore establishment has accumulated a good deal of experience with it is the problem that arises when a central authority establishes norms for decentralized units. So far there has been no indication that the Fleet Work Study Project will "over coordinate" in this manner. There is every reason to hope that staff-approved procedures will not be proposed as the only acceptable methods for use in the fleet.

If these two problems—line support and the avoidance of the implication of coercion—can be solved, the Fleet Work Study Program, like similar programs in industry, can be expected to produce handsome returns on a modest investment.

CHAPTER VI

SYSTEMS ANALYSIS FOR NAVAL UNITS

The preceding chapter is intended to show that a Fleet Work Simplification Program is a much-needed and highly practical activity promising great savings in manpower and money. This chapter adds the concept of "the system," or as often referred to, "the operational system" or the "administrative and work system."

A system may be defined as "the standardized operation of an organization in meeting one of its objectives."[1] A system is illustrated by the following description:

> Consider a . . . situation: that which arises when the passengers disembark from a ferry-boat. The boat approaches the quayside, its passengers ready; the port officials await its arrival. The whole situation is a system: a machine for disembarkation."[2]

The essence of the thoughts expressed in this chapter is that in the example of the ferry-boat, it will be all very well to simplify the duties of the customs officials, the baggage-handling crew and the disembarking passengers, but the real problem is one of improving the whole system, rather than the work of the individuals involved. An analysis of alternatives may show that the

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[1] For similar definitions see David Gindoff, "Getting the Most out of Manual Methods and Devices," Workshop for Management (Greenwich, Connecticut: The Management Publishing Company, 1956), p. 169; Robert A. McGowan in Victor Lazarro, (ed.), Systems and Procedures (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959), p. vi; and Frank A. Lamperti and John B. Thurston, Internal Auditing for Management (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1956), p. 67.

[2] Stafford Beer, Cybernetics and Management (New York: John Wiley and Sons, 1959), pp. 21-22. Mr. Beer is the head of the Operations Research Department of the United Steel Companies, Ltd. of Britain. The quote continues, reflecting the flavor of the British view and the realities of a system in operation: "And what happens? A great deal of shouting and turmoil begins, and continues for a long time. In the course of this passengers are pushed to and

the ferry-boat should be eliminated in favor of a bridge. Most views of work simplification do not take into account the much broader systems concept. One way of looking at this difference, perhaps, is that whereas work simplification has been categorized as to being engineer- worker- supervisor-oriented, the systems concept involves the level of an organization which assigns objectives to that organization. Systems are distinctly "management-oriented."

The systems concept has come into focus during the years since the Second World War.

> Modern statistical techniques and knowledge from different sciences were used /during World War II/, sometimes with striking effectiveness, in the comparison of military tactics, such as the various deployments of aircraft and ships. As these studies were used to assist in the operational decisions, they came to be known as 'operations research.' Since the war this general approach has been applied also to military development and procurement problems, which has meant peering further into the future, including a greatly expanding number of variables, examining a wider range of possible actions, and taking higher-level alternatives into account. This comparison of such enlarged systems of interrelated elements has often been called 'systems analysis.'[3]

During the past decade analytical investigation of systems has been increasingly used to help business firms increase their profits,

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fro, their luggage trampled, their tempers increasingly frayed. After some long delay of considerable discomfort and worry their trains eventually leave the quayside—probably at times grossly different from those forecast in the itinerary. These passengers, luckless people, philosophically accept the situation as typical of modern life. They accept that they are being 'controlled.' The inference is presumably drawn from the fact that there are officials standing about wearing badges of office and issuing instructions." Mr. Beer's introduction of the idea of "control" is an important factor in the concept of a system, as will be explained hereafter.

[3]Roland N. McKean, Efficiency in Government Through Systems Analysis (New York: John Wiley and Sons, 1958), (Copyright held by the Rand Corporation), p. 7.

and "virtually all of the defense budget is believed to contain opportunities for using /systems/ analysis to good advantage."

As might be expected, the analysis of a system can be a very complex operation. "Systems analysis encompasses the design of planning tools for giving direction to the enterprise's activities—the development of programs for determining what should happen in the future; and the design of control tools to insure that the plans are effected and the results evaluated."[5]

One of the developments which has accentuated the system concept is the introduction of computers into business organizations. "The impact of recent technical innovations has forced many managers to take a second look at their organization, particularly /in regard to/ the advent of modern data-processing equipment . . . Where managers have used it as more than simply a change in 'hardware', the equipment has triggerred sweeping revisions /in organizations and methods/. To prepare information efficiently for the processing equipment, managers have completely reorganized traditional departments. In this connection there are the telling, though perhaps exaggerated, stories of companies that have revised their organizations in anticipation of the delivery of data-processing equipment only to realize such great savings through the reorganization process itself that they cancelled the orders for the equipment."[6]

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[4] Ibid., p. 279.

[5] Norman N. Barish, Systems Analysis for Effective Administration (New York: Funk and Wagnalls Company, 1951), p. 2. As may be inferred from the date, this book offers a very basic approach to the understanding and analysis of systems. It lists twenty-four handy principles for the design of administrative systems. While this description of the cardinal rules is of considerable value, the emphasis placed on such matters as forms control and lay-out analysis borders on over-simplification.

[6] Frank J. Jasinski, "Adapting Organization to the New Technology," Harvard Business Review, XXXVII (January-February, 1959), p. 83. Or, as a pre-computer executive might tactfully

CHARACTERISTICS OF SYSTEMS

Several specific characteristics surround a system. These characteristics deal with:

1. The flow of information.
2. The integration of functional authority.
3. The characteristic of control.
4. The factor of complexity.
5. The contribution toward organizational effectiveness.

A system is built on a framework. This framework is the pattern of flow of information within an organization which leads to the accomplishment of an objective. "A prominent industrial leader has said, 'No physical activity goes on in our modern age without a piece of paper moving along with it. In most cases, several pieces of paper are used (not necessarily required) to get physical activity accomplished.'"[7] "In the United States, /perhaps/ 40 per cent or better of the total national effort goes into communications, computations, and /paperwork/."[8] "An integrated business system can be viewed as a communication process. Transactions occur, are recorded, and the record communicated or stored. . . In an integrated business system, three activities can be distinguished: (a) Information flow, direct transfer, (b) information

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acknowledge, "A few firms have placed letters of intent to purchase computers in order to get on waiting lists. Some of these have altered their original orders /as a result of the benefits derived from detailed studies of their systems/." George Kozmetsky and Paul Kircher, Electronic Computers and Management Control (New York: McGraw-Hill Book Company, Inc., 1956), p. 214.

[7]Milton Holzhaeuser, "The Work Simplification Concept," Workshop for Management (Greenwich, Connecticut: The Management Publishing Company, 1956), p. 211.

[8]William B. Worthington, "Basics of Electronic Systems," Ideas for Management (Forge Village, Massachusetts: The Murray Printing Company, 1959), p. 359.

process, report combining, and (c) information analysis, decision branching.[9] "At this stage, the general principle which can be deduced is that a . . . system is no loose conflux of events, but a tightly knit network of information."[10]

The second characteristic is that systems integrate functional authority. By nature they minimize traditional concepts of scalar levels and departmentalization. "An integrated business system links the event that originates an item of information with the events that occur whenever and wherever someone uses this information."[11] "Traditional business organization runs on a vertical line, relying almost solely on superior-subordinate relationships. Orders and instructions go down the line; reports and requests go up the line," says one observer.[12] "Frequently the traditional, formally defined vertical relations in business and industrial organization prove inadequate to cope with modern technology."[13] "Frederick W. Taylor and many others foresaw that only through a more specialized approach to division of effort could large enterprises be developed and managed . . . /but/ we now see that specialization is not an unmixed blessing. Carried beyond a certain point, the theory of division of effort begins to create more problems than it solves . . . The new industrial creed may well come to be termed: improvement through integration of effort."[14] "In almost all cases, systems are largely the result of a series of semi-related historical

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[10] Beer, op. cit., p. 23.

[11] Kozmetsky and Kircher, op. cit., p. 169.

[12] Jasinski, op. cit., p. 80.

[13] Ibid., p. 86.

[14] A. V. Feigenbaum, "The Approach, Analysis and Design of a System," Ideas for Management (Forge Village, Massachusetts: The Murray Printing Company, 1959), p. 54.

accretions."[15] "Management attention to this field begins with the premise that most important industrial operating elements are really independent parts of a broader system; and that efficient function/ing/ of a system is greater than the sum of the efficiency of its parts. . . The key parts of this system involve its objectives, policies, organization, physical resources, manpower, financial resources and procedures. It recognizes that systematizing the interrelated functioning of these elements requires far more than what we have historically known as procedures work."[16]

The essence of a system is the idea of control or correctiveness. Control is an attribute of a system, but "control" is used in a special sense to indicate "self-regulation."[17] A management control system may be a set of policies, procedures /and the related/ information processing which is designed to give direction to activities by clearly establishing goals, by measuring progress toward these goals and by indicating or initiating corrective action.[18]

The essential problem in control involves feed back of vital information and this process, of course, is closely related to the framework upon which all systems are built, the flow of information.

One factor pervading any analysis of a system is that a system may be exceedingly complex. "A system consists of x

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[15]Kozmetsky and Kircher, op. cit., p. 117.

[16]Foigenbaum, op. cit., p. 55. It certainly involves far more than the traditional concept of industrial engineering, which states that "the end result of the industrial engineering function is cost reduction." See H. B. Maynard, Industrial Engineering Handbook (New York: McGraw-Hill Book Company, 1956), pp. 1-37.

[17]Beer, op. cit., pp. 9-28.

[18]Donald G. Malcom, Real-Time Management Control in a Large Scale Man-Machine System (Santa Monica, California: The Systems Development Corporation, 1959), p. 3.

elements. Before we started talking about systems, this would have meant x investigations to find out what this set of things was like. Once we declare this set of things to be a system, however, there are not only x elements themselves to examine, but $x(x-1)$ relations between the elements to be examined."[19]

This complexity is introduced by emphasis on functional authority. Directives "coming from several different functional executives may overburden operating people, and occasionally they may even conflict with each other. Consider, for example, the district sales supervisor who receives instructions for rather elaborate accounting records from the chief accountant, training directions along with requests for frequent individual ratings from the personnel director, elaborate and glowing instructions regarding the next sales campaign from the sales promotion director, and weighty instructions from the legal counsel, all in addition to what presumably are the major orders received from his line supervisor, the sales manager. . . Each of the executives with functional authority is empowered to go directly to operating supervisors, and only occasionally is provision made for some central clearance . . . to make sure that all directions when combined together, make a consistent, do-able assignment."[20]

Systems can also be relatively simple. The power to assign objectives to portions of organizations is held by many functionaries. When these persons are Admirals, the systems called for are likely to be rather complex. On the other hand, janitors may also introduce systems.

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[19] Beer, op. cit., pp. 10, 12, 17, 98.

[20] This paragraph is largely quoted from Newman, op. cit., p. 195. A related concept that Newman brings out is that "use of functional authority tends to weaken the influence of the line supervisor." This is further reflection of the contention that departmentalization tends to restrain integration.

The final characteristic of a system is that it contributes to the effectiveness of an organization. Since a system is devoted to meeting one of the objectives of an organization, it absorbs some of the resources of the organization in the interest of meeting that objective. Systems can, of course, make a minus contribution toward the mission of the organization. An effective system, however, makes positive intentional contribution to the objective.[21]

THE PROBLEM OF SYSTEMS RESPONSIBILITY

As illustrated by the case of the overburdened sales supervisor, an increase in activity by functional authorities can seriously interfere with the primary duties of line authorities.[22] The problem of developing effective systems raises an important point: who is responsible for the efficiency of the system? Unfortunately, there is no clear answer to this question and several traditional concepts of responsibility appear to conflict with any requirement that a central authority assume responsibility for the correct functioning of a system.

The Navy concept of responsibility requires that unit Commanders assume responsibility for all occurrences within their units. Yet many, many Navy systems operate across unit boundaries and not in a vertical direction only. A substantial number of communications (indications that systems exist) pass up and down the chain-of-command between unit Commanders and their superiors and subordinates. But another very substantial number pass between the Bureaus and Offices of the Navy Department and the various

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[21] W. W. Suojanen, "Effectiveness, Efficiency and Economy in Military Management," Unpublished Manuscript, 1959, p. 2.

[22] As will be recalled, Taylor's plan for functional control of workers by eight functional bosses failed completely.

units. Functional instructions are issued directly to Commanders of all ships and stations by many officials outside the chain-of-command. Almost all of these instructions and communications are part of a systematic operation for meeting an objective--a system.

Examine the similarity between the situation of the line supervisor in the following case, and the position of the Navy unit Commander:

> Each division issued its own directives. In Finance, for example, when a particular problem was encountered, the manager would write a directive and distribute it to the entire organization explaining this particular feature or that particular feature about the subject in question. His cohort down the line, at the same level, would then issue a memorandum which merely touched upon the Finance problem, but which really dealt, let's say, with Public Relations. The line supervisor, down at the middle management level, was receiving communications from three or four sources touching on the same subject material. So the line supervisor was really in an undesirable position.[23]

The line supervisor described in the foregoing case is a victim of sub-optimization. Each superior authority has examined the problem at hand not from the overall view of the entire organization, but from the view only of the particular bureau or office he heads. This approach has "optimized" the situation with certain sub-portions of the organization. Each authority has "sub-optimized."[24] Should the authorities direct that action be taken by a very large number of supervisors,[25] without analyzing the

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[23]Clifton R. Irvine and Robert J. Koch, "Procedures Control and Analysis Techniques: A concept of Work Simplification," Workshop for Management (Greenwich, Connecticut: The Management Publishing Company, 1956), p. 217.

[24]For a good description of sub-optimization, see Roland N. McKean, op. cit., p. 31. Efficiency in Government Through Systems Analysis makes a very strong case for analyzing government systems in the interest of getting better results for tax expenditures.

[25]Or, say, "All Ships and Stations."

system to assure that it is designed for efficient operation, the resulting wasted effort can be enormous as each supervisor tries to "cope" as best he can.

The foregoing comments are not offered in a spirit of criticism, for even among the best-managed organizations, many are found that have not yet solved the problem of responsibility for optimizing the efforts of the organization. Few organizations are as large or as decentralized as is the Navy, and this problem is particularly acute in decentralized organizations. Peter F. Drucker has stated:

> Then take the trend toward decentralization of industry. This is a very misleading term because it obscures the fact that you cannot decentralize without very much better controls of performance, very much better controls of objectives, than most businesses have ever heard of. Decentralization means that you set up a unit autonomously in such a manner that it operates against standards, objectives and goals rather than against supervision. The major problem is a control problem which very few businesses understand or have the controls for. Many who go ahead and decentralize are going to rue the day.[26]

Although the problem of responsibility for efficient systems has not been effectively solved by many very enterprising organizations, there are indications that it is being solved more effectively in certain organizations than in the Navy. One of the indications is that a long list of prominent companies assign considerable talent to this particular problem, or some variation of it. Any number of companies specifically assign "Systems Engineering Groups" or "Planning and Procedures Departments" to this field. So far, it is not apparent that the Navy has given much attention to its systems, with the possible exception of the occasional efforts of the Navy Management Office to serve in the

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[26] Peter F. Drucker, quoted in Kosmetsky and Kircher, op. cit., p. 147.

role of a management consultant to the operating forces.[27]

Why is it that systems should require the attention of highly competent systems analysis groups, despite the fact that, by and large, most of the personnel of an organization are thoroughly qualified, sincere persons who are doing their work in what they consider to be the best manner? The following reasons, it will be noted, apply in some degree to organizations ranging in size from very large to very small:

1. The systems in many concerns have been established over long periods of time as required by the various supervisors, department heads or top management. Many of these systems were probably very good at one time; some were not good even when adopted.
2. Some of the apparently good systems were built around the special abilities and personalities of the persons in the organization. Systems designed to accomodate one particular set of abilities which are no longer present in the organization do not operate well.
3. Many originally good systems have become bad ones because the character of the business operations has changed without corresponding adjustments in the systems. Outmoded systems remain in effect, but with deteriorated value.
4. An activity is sometimes assigned to a department because of its physical location, or for some other convenient but organizationally illogical reason.
5. As a company grows and new functions are added, it is necessary to redesign old systems and to develop carefully

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[27]For an example of the role of the Navy Management Office in assisting in the battle against paperwork see "CINCNELM Reviews Administrative Practices," Navy Management Review, IV (November, 1959), p. 4.

perfected new ones to handle the added activities. Otherwise, the "layering effect" takes place, and the net effect of all the added systems—each one good when considered by itself—will be poor coordination, and wasted effort.

6. In many cases systems are started as stopgap measures, but instead of being dispensed with when no longer needed they achieve a status of permanence.

7. Poor systems accumulate because people tend to cling to those things to which they are accustomed. Meanwhile, the technology of the age is rendering older systems obsolete at an increasing rate.

8. Since there is at present no system for inspecting or evaluating systems in the operating forces, or most of the rest of the Navy, many unacceptable systems have not been positively identified, improved or eliminated.[28]

Although organizations in general are vulnerable to encroachment by poor systems, there are many very efficient systems in operation in the Navy today. Two excellent examples of highly detailed systems which operate well without imposing burdens on the command structure are:

1. The Enlisted Distribution System which has revolutionized personnel planning and assignment procedures, placed seashore rotation on an equitable basis and offers to shape enlisted careers into predictable, realistic patterns. This has been accompanied with a reduction of effort formerly devoted by units to manpower planning, and by an increase in the personal consideration that can be given to each transferee.

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[28]The first seven of the reasons listed above are based on Barish, op. cit., p. 6.

2. The BuWeps system for reporting defective aviation material, which ties quality control to fleet material usage. By means of simply prepared reports, information on failed aviation equipment is promptly brought to the attention of quality control organizations. This system is designed to encourage preparation of the reports at the lowest level of the operating unit which can combine knowledge of facts and completeness of preparation. A typical report is prepared in pencil by a junior petty officer, reviewed by a CPO, forwarded to the Aviation Safety Center where it is evaluated and, possibly, sent on to the manufacturer of the failed material. Important failures, of course, are given additional attention by the chain-of-command.

It will be noted that these two systems involve:

1. A flow of information. Both systems handle a great deal of information, but a minimum of effort is required for its preparation.
2. The integration of functional authority. The information flows directly to the elements concerned, the chain-of-command is not directly concerned.
3. The characteristic of control. Over individuals in the one case, failure data in the other.
4. The factor of complexity. Both are relatively simple at the lower levels and become increasingly complex as the information becomes centralized.
5. A contribution toward the effectiveness of the Navy. The two systems add greatly to the ability of the Navy to reach its objectives.

Using the two sample cases as guides, what other systems might lend themselves to examination? There are hundreds of systems in operation in any large-scale organization, and dozens in even the smallest Navy organizations. The systems described below illustrate: (a) the types of systems which can easily be brought under examination

with promise of meeting objectives at reduced cost, and (b) the point at which responsibility for instituting this review lies in each case.

Case Examples.

1. A ship's personnel officer institutes a check-in/check-out system for persons reporting aboard or departing. By eliminating non-essential entries and arranging the remaining card entries in a logical order, he can minimize the time required for check-in/check-out. Following the principle of management by exception, he can limit the number of required card entries. For example, persons who can state that they have no dealings in progress with the library need not be required to call at the library. Signatures need not be required where check-in/check-out can be accomplished by telephone, etc.

   Responsibility. The person instituting the system is responsible for determining that it will operate with maximum efficiency, and for reviewing it periodically.

2. A Fleet Commander requires specified information at periodic intervals. By examining the preferred techniques for assembling the necessary information and the most desirable methods for collecting the information (typed reports, reviewed by all authorities on the chain-of-command, versus, perhaps, check-the-box postcards prepared by individuals concerned) he assures that minimum effort will be absorbed by the system consistent with the command emphasis to be given the system.

   Responsibility. Same as Example 1.

3. A Bureau analyzes its manuals and directives and finds that several of its instructions deal with the same matter. By combining the directives into simplified form, the work required to comply with the directives is reduced. This technique was used by BuPers in combining some sixty Instructions

and Notices into one document. The result was substantial improvement in the performance of units operating under the prescribed system.

Responsibility. Same as Example 1.

4. A Destroyer Flotilla Commander observes that the ships of one division frequently require a shorter time to rig for fueling (paint their hulls or respond to correspondence, etc.) than do most other ships of his flotilla. By analyzing the systems utilized by the fast-acting division he is able to publicize the preferred method to the other units, thus raising the effectiveness of the entire force.

Responsibility. The Flotilla Commander has the responsibility for analyzing and introducing improved methods. However, once the improved methods become known to the flotilla, the Commanding Officers then assume the responsibility. Until then, the responsibility remains at the lowest level that is aware of the problem, the Flotilla Commander.

5. A PO1 establishes a divisional logs and records system. The petty officer should assure himself that a minimum of effort is absorbed in recording essential information and that non-essential information is omitted. If the record is expected to contain repetitious entries, he should consider using a stamp, an embossing technique or a check-list. He should eliminate the record as soon as it has served its purpose.

Responsibility. The authority who established the new system, the PO1.

6. A Work Study Team determines in conjunction with a carrier administrative office that a training effort requiring x instruction hours and y student hours produced z results in the following programs: (a) advancement-in-rate training program, (b) safe driving program, (c) moral leadership program, (d) shipboard orientation program, etc. By increasing or decreasing the training effort, optimum results can be estimated for similar programs.

> Responsibility. The head of the Work Study Team is obligated to inform all authorities who will be involved in similar programs. He should recommend that further efforts in these areas take the xyz formula into account and feed back additional information for further distribution. Once provided with the information, line authority assumes the responsibility for instituting such systems as are appropriate to the units concerned.[29]

This review of selected systems has examined the problem of fixing responsibility for efficient systems. As a result of this brief review, it can be tentatively suggested that responsibility for efficiency of a system (and the elimination of an ineffective system) lies with one of the following authorities: (a) the authority who institutes the system, (b) a higher authority who recognizes the need for an improved system, or (c) a staff authority, which recognizes the need for an improved system. This staff authority is eventually relieved of responsibility by the cognizant line authority (a) or (b) above.

As a final observation, it appears that it will be difficult to show that most systems now in use by the operating forces of the Navy are more efficient than similar systems in civilian organizations. It is common experience in industrial applications to find that very substantial improvements in efficiency—the return of useful output

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[29] For an opposing view which holds that no staff authority has responsibility for introducing improved systems, see Philip H. Thurston, Systems and Procedures Responsibility (Boston: Soldiers Field, Harvard University, 1959), p. 26 et seqq. This limited view of responsibility is not shared by professional management analysts who often assume the burden of responsibility for improving systems until relieved of it by line authority. Until line authority has an awareness of both the problem and the solution, however, systems specialists must retain the responsibility for attempting to install the most efficient systems possible. Only rejection of the proposed system by informed line authorities relieves the staff authority of responsibility.

for given useful input[30]—are brought about by analysis and adjustment of systems. If Navy organizations cannot claim levels of efficiency comparable to those of industry, the implication is that the work habits and work systems of the Navy deserve analytical attention.

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[30] W. W. Suojanen, op. cit., p. 3.

CHAPTER VII

CONCLUSIONS

I. Work simplification and systems analysis are techniques widely used by industry and to a lesser extent by the shore establishment. The results of these practices have been important savings in manpower and money, or greatly increased output without an increase in input.

II. The operating forces have begun to install a formal work simplification (work study) program, and have not yet instituted a systematic systems analysis program.

III. The Work Study Program presently contemplated is a modest-scale effort which may be expected to repay its costs many times over.

IV. The Work Study Program appears to be specifically designed to avoid the stresses and conflicts which frequently occur when aggressive work simplification programs are instituted.

V. Finding the best compromise between maximum implementation of improved procedures and minimum adverse reaction by affected organizations will require a high level of adroitness on the part of the work study authorities.

VI. The prime lesson learned from the experience of industry and the shore establishment is that administration of a program of this nature by a centralized authority leads to emphasis on the interchangeability of procedures. However, central authorities are rarely in a position to insist on the adoption of specific procedures without consultation with the units involved.

VII. The systems analysis concept, which broadly embraces all methods for accomplishing an organization's objective in an efficient manner has been applied only to a very limited extent by the operating forces. Even more than work simplification, systems analysis promises very substantial increases in the ability to reach organizational objectives without increased consumption of resources.

VIII. The primary problem in applying systems analysis involves placing responsibility for the efficiency of the system. Since systems integrate functional authority, traditional patterns of responsibility may not sufficiently encompass all the systems which apply to a given organization. A preliminary evaluation of several sample systems suggests that responsibility for efficient systems lies with one of three authorities:

1. The authority who institutes the system,
2. A higher authority who recognizes the need for an improved system, or
3. A staff authority which recognizes the need for an improved system.

CHAPTER VIII

RECOMMENDATIONS

It is recommended that:

I. The Fleet Work Study Program proceed at the maximum practical rate.

II. The Fleet Work Study Group adopt dynamic rather than permissive methods of selecting subjects for study.

III. In publishing its findings, the Fleet Work Study Group continue the well-chosen policy of not insisting on fleet-wide adoption of centrally-selected methods. A fine balance must be established between centralized study and decentralized implementation.

IV. The Fleet Work Study Group expand its efforts to include considerably more than developing simplified working procedures. This expansion of effort should emphasize analysis of the systems utilized in meeting Navy objectives, with a view toward achieving the objectives with a reduction of assigned resources.

V. In work study training programs, the responsibility of both line and staff authorities for efficient systems be clearly explained.

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